How does infection of group members affect collective performance?

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Introduction

In insect societies, selection takes place at the level of the colony, so performance of collective tasks is crucial for colony survival (Hölldobler et al., 2009). Group living can enable animals to solve problems that are difficult or impossible for individuals to solve on their own. However, group living also has negative impacts, such as becoming more vulnerable to diseases through frequent contacts among group members (Altizer et al., 2003). While past research has focused mainly on how introduction of a pathogen in an ant colony leads to changes in individual behaviour (Stroeymeyt et al., 2018; Ugelvig & Cremer, 2007), we still know very little about how the presence of pathogens affects the collective tasks performed by a colony. In this project, I will investigate if and how pathogens affect individual behaviors and collective performance using *Temnothorax rugatulus* ants as a model system.

Results

Currently, I have performed individual assays to see the effect of LPS on individual movement behaviour. I found a significant difference between the distance moved by ants injected with PBS and LPS, 6 hours after injection.

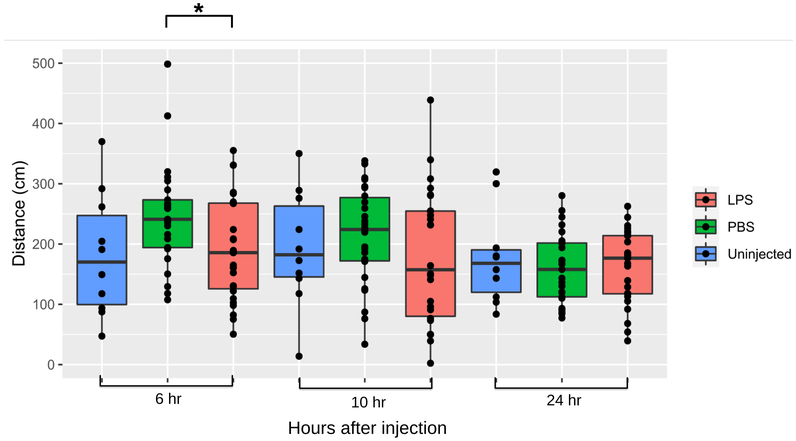


Fig 1. Distance moved by an individual ant 6, 10 and 24 hours for an uninjected ants (blue, n = 10), ants injected with PBS (green, n = 21) or ants injected with LPS (red, n = 21)

Discussion

I found that ants injected with PBS move less than those injected with LPS 6 hours after injection. Within 10 hours of injection, the effect of LPS on the distance moved seems to have disappeared. However, I do not see a significant difference between uninjected and LPS- injected ants, even 6 hours after injection. Previous studies have found ants diseased ants show differences in interactions with other nestmates (Aubert & Richard, 2008), and spent more time outside the nest (Stroeymeyt et al., 2018). It is possible that disease affects the interaction network in the colony, but not the movement of an isolated ant, and more work needs to done to investigate this.

Future directions

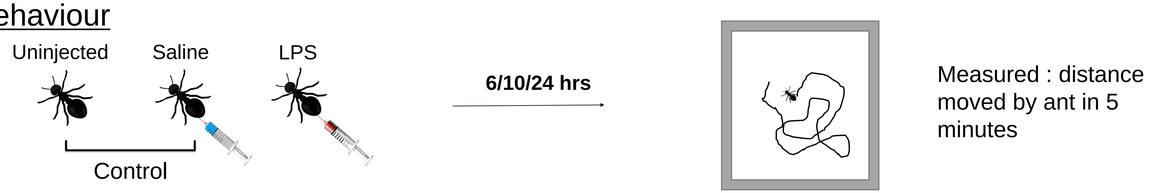
In addition to changes in distance moved, I also qualitatively noticed differences in the route taken among the treatment groups. I plan to quantify these differences in movement patterns – amount of time paused by an individual, the area explored by an individual and the amount of time spent near the walls of the arena.

If individual ants change their movement behaviours when infected, I will use this information to explore how changes in individual behaviour due to disease scales up and affects collective outcome.

Materials and methods

Model system : *T. rugatulus* colonies, individuals injected with LPS (lipopolysaccharide), an immune system activator

<u>Effect of LPS on individual behaviour</u>



<u>Effect of LPS on collective behaviour</u>

Inject different proportion of workers in colony and see how collective performance on house hunting task is impacted

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